

DOCUMENTATION OF ENVIRONMENTAL INDICATOR DETERMINATION
Interim Final 2/5/99
RCRA Corrective Action
Environmental Indicator (EI) RCRIS code (CA750)
Migration of Contaminated Groundwater Under Control

Facility Name: Merck & Co., Inc. - Stonewall Plant
Facility Address: Elkton, Virginia
Facility EPA ID #: VAD001705110

1. Has **all** available relevant/significant information on known and reasonably suspected releases to the groundwater media, subject to RCRA Corrective Action (e.g., from Solid Waste Management Units (SWMU), Regulated Units (RU), and Areas of Concern (AOC)), been **considered** in this EI determination?

 X If yes – check here and continue with #2 below.

 If no – re-evaluate existing data, or

 If data are not available skip to #6 and enter “IN” (more information needed) status code.

BACKGROUND

Definition of Environmental Indicators (for the RCRA Corrective Action)

Environmental Indicators (EI) are measures being used by the RCRA Corrective Action program to go beyond programmatic activity measures (e.g., reports received and approved, etc.) to track changes in the quality of the environment. The two EI developed to-date indicate the quality of the environment in relation to current human exposures to contamination and the migration of contaminated groundwater. An EI for non-human (ecological) receptors is intended to be developed in the future.

Definition of “Migration of Contaminated Groundwater Under Control” EI

A positive “Migration of Contaminated Groundwater Under Control” EI determination (“YE” status code) indicates that the migration of “contaminated” groundwater has stabilized, and that monitoring will be conducted to confirm that contaminated groundwater remains within the original “area of contaminated groundwater” (for all groundwater “contamination” subject to RCRA corrective action at or from the identified facility (i.e., site-wide)).

Relationship of EI to Final Remedies

While Final remedies remain the long-term objective of the RCRA Corrective Action program the EI are near-term objectives which are currently being used as Program measures for the Government Performance and Results Act of 1993, GPRA). The “Migration of Contaminated Groundwater Under Control” EI pertains **ONLY** to the physical migration (i.e., further spread) of contaminated ground water and contaminants within groundwater (e.g., non-aqueous phase liquids or NAPLs). Achieving this EI does not substitute for achieving other stabilization or final remedy requirements and expectations associated with sources of contamination and the need to restore, wherever practicable, contaminated groundwater to be suitable for its designated current and future uses.

Duration / Applicability of EI Determinations

EI Determinations status codes should remain in RCRIS national database **ONLY** as long as they remain true (i.e., RCRIS status codes must be changed when the regulatory authorities become aware of contrary information).

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2. Is **groundwater** known or reasonably suspected to be “**contaminated**”¹ above appropriately protective “levels” (i.e., applicable promulgated standards, as well as other appropriate standards, guidelines, guidance, or criteria) from releases subject to RCRA Corrective Action, anywhere at, or from, the facility?

 X If yes – continue after identifying key contaminants, citing appropriate “levels”, and referencing supporting documentation.

 If no – skip to #8 and enter “YE” status code, after citing appropriate “levels”, and referencing supporting documentation to demonstrate that groundwater is not “contaminated.”

 If unknown – skip to #8 and enter “IN” status code.

Rationale and Reference(s):

The key contaminants above the drinking water MCLs are: Benzene, Chlorobenzene, Chloroform, Methylene Chloride, Naphthalene, Trichloroethene, Vanadium, and Vinyl Chloride—1) Site-wide Bedrock Groundwater Sampling Report – August 2003 and November 2004 Events (March 2005), 2) Sanitary Landfill Permit #183, 2004 Annual Groundwater Monitoring Report (February 2005), 3) Results of Biosparging Pilot Tests Performed in Groundwater North of the Landfill (July 2005)..

Footnotes:

¹ “Contamination” and “contaminated” describes media containing contaminants (in any form, NAPL and/or dissolved, vapors, or solids, that are subject to RCRA) in concentrations in excess of appropriate “levels” (appropriate for the protection of the groundwater resource and its beneficial uses).

3. Has the **migration** of contaminated groundwater **stabilized** (such that contaminated groundwater is expected to remain within “existing area of contaminated groundwater”² as defined by the monitoring locations designated at the time of this determination)?

 X If yes – continue after presenting or referencing the physical evidence (e.g., groundwater sampling/measurement/migration barrier data) and rationale why contaminated groundwater is expected to remain within the (horizontal or vertical) dimensions of the “existing area of groundwater contamination”²).

 If no (contaminated groundwater is observed or expected to migrate beyond the designated locations defining the “existing area of groundwater contamination”²) – skip to #8 and enter “NO” status code, after providing an explanation.

 If unknown – skip to #8 and enter “IN” status code.

Rationale and Reference(s):

Review of the August 2003 and November 2004 site-wide bedrock sampling results, the Biosparging Pilot Test Report (August 2005), Monitored Natural Attenuation Report for the March 2005 Sampling, and May 2004 and November 2004 Semi Annual Groundwater Monitoring Results from the landfill at this facility indicate that at least six contaminants, identified in groundwater from point of compliance monitoring wells DM-11, DM-13 and DM-17, have exceeded applicable standards but remained at stable or declining concentrations over this time period and show reduction from the historic high concentrations measured at these wells. These contaminants are Acetone, Benzene, Cis-1,2-Dichloroethene, Naphthalene, Trichloroethene, and Vinyl Chloride. The monitoring wells are located downgradient from the landfill and upgradient from the South Fork of the Shenandoah River.

From the Semi Annual data collected at the Sanitary Landfill point of compliance wells and the results of the biosparging pilot study, it appears that chemical and physical reactions are taking place in the groundwater which will be enhanced by the implementation of the full-scale biosparging system. While concentrations significantly greater than applicable groundwater quality standards are still measured in wells at the facility, the downward trend in concentrations facility-wide supports a determination that on a site-wide basis, the plume is stable and in places, shrinking. The vertical extent of the groundwater plume is assumed to be further defined by discharge to the river north of the landfill.

Footnotes:

² “existing area of contaminated groundwater” is an area (with horizontal and vertical dimensions) that has been verifiably demonstrated to contain all relevant groundwater contamination for this determination, and is defined by designated (monitoring) locations proximate to the outer perimeter of “contamination” that can and will be sampled/tested in the future to physically verify that all “contaminated” groundwater remains within this area, and that the further migration of “contaminated” groundwater is not occurring. Reasonable allowances in the proximity of the monitoring locations are permissible to incorporate formal remedy decisions (i.e., including public participation) allowing a limited area for natural attenuation.

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4. Does “contaminated” groundwater **discharge** into **surface water** bodies?

Rationale and Reference(s):

- X If yes – continue after identifying potentially affected surface water bodies
- If no – skip to #7 (and enter a “YE” status code in #8, if #7 = yes) after providing an explanation and/or referencing documentation supporting that groundwater “contamination” does not enter surface water bodies
- If unknown – skip to #8 and enter “IN” status code.

Groundwater data from facility perimeter wells MW04, MW32, MW33, and MW34 was generated during the May and November 2004 site-wide sampling events. Monitoring wells MW04 and MW-34 are located generally downgradient from the Landfill and within 100 to 150 feet from the South Fork of the Shenandoah River. Monitoring wells MW-32 and MW-33 are located on the opposite side of the river from the Landfill. The data from these wells indicate that of these perimeter wells only data from MW-04 and MW-04M exceed the applicable groundwater quality standards. Based upon this, it can then be reasonably assumed that contaminated groundwater could be discharging to the river.

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5. Is the **discharge** of “contaminated” groundwater into surface water likely to be “**insignificant**” (i.e., the maximum concentration³ of each contaminant discharging into surface water is less than 10 times their appropriate groundwater “level,” and there are no other conditions (e.g., the nature, and number, of discharging contaminants, or environmental setting), which significantly increase the potential for unacceptable impacts to surface water, sediments, or eco-systems at these concentrations)?

Rationale and Reference(s):

_____ If yes – skip to #7 (and enter “YE” status code in #8 if #7 = yes), after documenting: 1) the maximum known or reasonably suspected concentration³ of key contaminants discharged above their groundwater “level,” the value of the appropriate “level(s),” and if there is evidence that the concentrations are increasing; and 2) provide a statement of professional judgement/explanation (or reference documentation) supporting that the discharge of groundwater contaminants into the surface water is not anticipated to have unacceptable impacts to the receiving surface water, sediments, or eco-system.

X If no – (the discharge of “contaminated” groundwater into surface water is potentially significant) - continue after documenting: 1) the maximum known or reasonably suspected concentration³ of each contaminant discharged above its groundwater “level,” the value of the appropriate “level(s),” and if there is evidence that the concentrations are increasing; and 2) for any contaminants discharging into surface water in concentrations³ greater than 100 times their appropriate groundwater “levels,” the estimated total amount (mass in kg/yr) of each of these contaminants that are being discharged (loaded) into the surface water body (at the time of the determination), and identify if there is evidence that the amount of discharging contaminants is increasing.

_____ If unknown – skip to #8 and enter “IN” status code.

Rationale and Reference(s):

The benzene concentration of 2400 ppb measured in MW-04M during the November 2004 sampling event exceeds 10 times and 100 times the MCL of 5 ppb for that constituent. Therefore in accordance with the instructions for this determination, the discharge cannot be characterized as insignificant.

Footnotes:

³ As measured in groundwater prior to entry to the groundwater-surface water/sediment interaction (e.g., hyporheic) zone.

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6. Can the **discharge** of “contaminated” groundwater into surface water be shown to be “**currently acceptable**” (i.e., not cause impacts to surface water, sediments or eco-systems that should not be allowed to continue until a final remedy decision can be made and implemented⁴)?

 X If yes – continue after either:

- (1) identifying the Final Remedy decision incorporating these conditions, or other site-specific criteria (developed for the protection of the site’s surface water, sediments, and ecosystems), and referencing supporting documentation demonstrating that these criteria are not exceeded by the discharging groundwater; OR
- (2) providing or referencing an interim-assessment⁵, appropriate to the potential for impact, that shows the discharge of groundwater contaminants into the surface water is (in the opinion of a trained specialists, including ecologist) adequately protective of receiving surface water, sediments, and eco-systems, until such time when a full assessment and final remedy decision can be made. Factors which should be considered in the interim-assessment (where appropriate to help identify the impact associated with discharging groundwater) include: surface water body size, flow, use/classification/habitats and contaminant loading limits, other sources of surface water/sediment contamination, surface water and sediment sample results and comparisons to available and appropriate surface water and sediment “levels,” as well as any other factors, such as effects on ecological receptors (e.g., via bio-assays/benthic surveys or site-specific ecological Risk Assessments), that the overseeing regulatory agency would deem appropriate for making the EI determination..

 If no – (the discharge of “contaminated” groundwater into surface water is potentially significant) continue after documenting: 1) the maximum known or reasonably suspected concentration³ of each contaminant discharged above its groundwater “level,” the value of the appropriate “level(s),” and if there is evidence that the concentrations are increasing; and 2) for any contaminants discharging into surface water in concentrations³ greater than 100 times their appropriate groundwater “levels,” the estimated total amount (mass in kg/yr) of each of these contaminants that are being discharged (loaded) into the surface water body (at the time of the determination), and identify if there is evidence that the amount of discharging contaminants is increasing.

 If unknown – skip to #8 and enter “IN” status code.

Rationale and Reference(s):

In response to DEQ’s concerns about the effect the potential discharge of contaminated groundwater would have on surface water quality, Merck implemented a surface water monitoring program (February/March 2005 Surface Water Sampling Report) as part of the Corrective Measures Implementation Workplan approved by DEQ in September 2004. No contaminants were detected above the Virginia Water Quality Standards during the first two rounds of sampling.

To address the potential for continued contaminated groundwater discharge to the river which may cause unacceptable impacts to surface water quality, the biosparging pilot study was designed and implemented. Based upon those results, a full scale system is anticipated. This in conjunction with cap placed on the landfill in 2001 will further reduce the potential contaminant discharge to the river near the landfill.

Footnotes:

⁴ Note, because areas of inflowing groundwater can be critical habitats (e.g., nurseries or thermal refugia) for many species, appropriate specialist (e.g., ecologist) should be included in management decisions that could eliminate these areas by significantly altering or reversing groundwater flow pathways near surface water bodies.

⁵ The understanding of the impacts of contaminated groundwater discharges into surface water bodies is a rapidly developing field and reviewers are encouraged to look to the latest guidance for the appropriate methods and scale of demonstration to be reasonably certain that discharges are not causing currently unacceptable impacts to the surface waters, sediments or eco-

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systems.

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7. Will groundwater **monitoring** / measurement data (and surface water/sediment/ecological data, as necessary) be collected in the future to verify that contaminated groundwater has remained within the horizontal (or vertical, as necessary) dimensions of the “existing area of contaminated groundwater?”

 X If yes – continue after providing or citing documentation for planned activities or future sampling/measurement events. Specifically identify the well/measurement locations which will be tested in the future to verify the expectation (identified in #3) that groundwater contamination will not be migrating horizontally (or vertically, as necessary) beyond the “existing area of groundwater contamination.”

 If no – enter “NO” status code in #8. skip to #7 (and enter a “YE” status code in #8, if #7 = yes) after providing an explanation and/or referencing documentation supporting that groundwater “contamination” does not enter surface water bodies

 If unknown – skip to #8 and enter “IN” status code.

Rationale and Reference(s):

Groundwater and surface water monitoring requirements are contained in the approved CMI Workplan and the permit modules incorporating the requirements of the Virginia Solid Waste Regulations for the landfill.

